

TECHNICAL NOTE

Date 27th Feb 2013 (rev 3)
ref TN294

Raised by: DB/TC/DP

Distributed to: as required

Soundtracs - Digico(UK) Ltd. unit 10 Silverglade Business Park Chessington Surrey KT9 2QL England
Tel: +44 1372 845600 Fax: +44 1372 845656 email: support@digiconsoles.com

SD Series MADI Implementation

The MADI or AES-10 Standard, originated in the 1980's to support serial digital transmission of up to 64 channels of digital audio over coaxial or fibre optic cable at sampling rates of up to 96K with a resolution of up to 24 bits per channel.

The Original AES10 Standard defined MADI as a multichannel transport for linking central control areas, mixing consoles to digital multi-track recorders. It was updated in 2003 and again in 2008 adding 64 channel and 96KHz sample rates support. Soundtracs mixers have used MADI since the mid 90's, including 96KHz operation since 1999, being the first large format mixers to do so.

Digico Coaxial Cable

Standard external cables supplied by Digico (5m, 50m or 100 m) are standard 75 ohm BNC and manufactured with European specification RG59U cable (Note this is NOT the same specification as USA standard RG59B.) This is basically a good quality video connection cable.

In addition, factory cable connectors are individually pull tested to 5Kg. Many cheap ready-made cables would fail this test. The importance of good quality terminations cannot be overstated.

It should be noted that MADI is approximately 0.5V RMS 125MHz serial data. Earth (ground) differentials of over 0.25V due to poor power wiring will effectively stop the system from functioning.

The recommended 75 ohm cable RG59U specification and test characteristics are fully detailed in information on MADI coaxial cable, please consult Digico Technical Bulletin 106.

The maximum distance that a MADI signal can be sent is dependent on the performance of both the cable and the equipment being connected.

Digico Optical cable

The SD series Optocore ® connection is not within the scope of this note. Optical MADI is available by using the Digico Purple Box external convertor unit, to convert from coaxial (BNC) or Digico Cat5 (RJ45) to a standard optical MADI connection and using the DigiGrid range to convert to Ethernet. Note is not the same data format as the Optocore system. Refer to published information for further details of these convertors.

This optical connection can be used with 3rd party systems which are not equipped for coaxial MADI or where long distance connections are required. The optical cable options available for optical MADI are detailed in Digico Technical Bulletin 101

Console MAD I connection formats

DiGiCo SD Series consoles have 2 distinct types of MAD I Connection:-

SD/DigiRack MAD I connection.
Standard MAD I (called Std MAD I) connection

Console MAD I connections at 48K

Connecting a console to a **SD-Rack at 48K**

Each connection contains 56 Channels of audio plus the rack control data on CH57 thus allowing the 56in/56out configuration with a pair of co-ax cables. Channels 58-64 are not present.

Connecting **Standard MAD I at 48K**

This is selected in the Audio IO Page, that is a 56 channel MAD I connection. Channels 57-64 are unused / ignored. It is worth noting that, if 56 channel is selected, some 3rd party MAD I interfaces will not accept a 56 channel MAD I connection as valid, although this is within the AES-10 specification.

In general a standard MAD I connection taken from a SD-series mixer or the auxiliary output of an SD-Rack, can be used for recording 56 channels at 48KHz without further adjustment. The SD Rack MAD I split outputs can be set to output a 64 Channel MAD I signal although no audio will be present on channels 57-64.

Console MAD I connections at 96K

When connecting via MAD I at 96K, the connection requires the use of 2 console MAD I ports (4 BNC connections rather than 2) for the 56 or 64 in/out. You need 2 pairs of cables to connect for 56 or 64 channels of audio.

Note on some SD mixers there are redundant MAD I port connections, marked 1A and 1B etc. 96K requires the use of port 1A and port 2A (or port 1B and port 2B) and NOT 1A & 1B or 2A & 2B etc. A mixer with 2 (or 3) ports will allow only one 96K connection in software, a 4 port mixer will allow only two 96K connections in software.

Connecting a console to a **SD-Rack at 96K**

A SD Rack MAD I connection can only be an SMUX connection (see below), which is preselected in the console software.

When SD rack is connected to a console, the first MAD I port contains the audio for channels 1-28 plus the rack control data for those channels. The second port contains the audio for channel 29 - 56 plus the rack control data for those channels

Connecting **Standard MAD I at 96K**

Currently, each SD Series Engine 96K MAD I connection works in 1 of 2 modes. The switch between the 2 modes is located in the Audio IO Page. The common names for these 2 modes are S-MUX (48K Frame) and Hi-Speed (96K Frame) but others may be found, sometimes leading to confusion. These modes are not compatible.

Cont/

SMUX Mode:- Up to 32 channels using a 48KHz base sample rate in which channel pairs to represent a 96KHz signal. This sends pairs of (odd and even) 96K samples for each channel in sequence (channels 1-28 in that order) in the data stream (for 56 channel use).

Hi-Speed Mode:- Up to 32 channels at the true 96K sample rate. This sends the odd (first) sample for all 28 channels followed separately by the even (second) sample for 28 channels in the data stream (for 56 channel use).

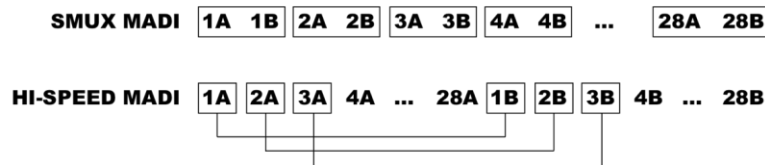
It is worth noting that this format is not actually “high speed” and the data signal rate is identical to S-MUX but the signals are presented in a different order.

When connecting via MADi at 96K the first MADi port contains the audio for channels 1-28. The second port contains the audio for channel 29 - 56.

It is important to select the correct 96K MADi type (SMUX or Hi-Speed) when using Std MADi to connect to 3rd party equipment (recorders, routers etc.). As noted, this is on the Audio IO page. If the wrong type of connection is selected, then audio will appear on the wrong channels on the receiving device.



2 standards for configuration of data within a 96K MADi Stream



An SD Series console will auto detect which type of incoming 96K MADi stream is connected to it and configure the input accordingly.

Note the auxiliary output from a SD-Rack is fixed for S-MUX use only. If a Hi-Speed connection is required, this must be taken from a mixer output.